the objects they so grandly figure and often so elaborately describe. Even the reports of scientific expeditions may frequently be searched in vain for this kind of information, which has to be gleaned from authorities not always trustworthy, from scattered papers, or from books of travel such as have been issued in this country on the Malay Archipelago and the River Amazon. It is mortifying to exhibit forms distinguished by extraordinary developments of structure, and to be able to say nothing on associated habits. Such strange developments were once considered to be mere freaks of nature, but no one now doubts their having a biological and even a genealogical significance. What a field is is here opened! How little of the biology of a new form has been exhausted when it has been collected, named, described, figured, and even dissected! Scientific treatises have prepared the foundation for a solid knowledge of the subject, but there would be occasion for regret if biology should ever come to be regarded by students in an aspect too exclusively histological or even physiological, if such a view operated to the prejudice of genuine out-of-door observations. The greatest advance in Natural History made in the present, or perhaps in any other generation, has been mainly accomplished by two observers who are pre-eminently life-historians.

Little need be said of the miscellaneous illustrations contained in the upright portion of the table-cases. They seem to be very successful in engaging the attention of visitors of all classes—a point which is felt to be of prominent importance where the admissions amount to about 2,000 daily. What brings them here? is a question which again and again suggests itself. Reduce the number by all the idlers and sight-seers who, no doubt, constitute a large proportion of the gathering; still, if only 100 or even 50 seek some kind of instruction, even these in the course of a year form a large and teachable class. As a firm believer in the humanising effect of an intelligent interest in Natural Science, to myself the grand museum problem seems to be, how to make such an institution most beneficial to the greatest number.

HENRY H. HIGGINS

PRE-EUCLIDIAN GEOMETRY

Die Geometrie und die Geometer vor Euklides. Von Prof. C. A. Bretschneider. (Leipzig: B. G. Teubner, 1870. London: Williams and Norgate.)

UNTIL the appearance of this book, Montucla's celebrated "History of Mathematics" contained almost all that was known about the early history of Mathematics up to the present time. Later historians, even the careful Chasles, have almost exclusively copied him, without taking the trouble of searching the Greek writings for themselves. Montucla's remarks, however, are not only meagre, they are even not always correct. For this reason Prof. Bretschneider has collected all important passages in Greek writings which refer to the state of Geometry in Greece in the time before Euclid. This author is the first of whom complete works have reached us; with him, therefore, a *History* of Geometry begins. With regard to the ante-Euclidian times we cannot advance beyond conjectures, and these will always depend more or less upon the individuality of the historian. Perfectly aware of this, Prof. Bretschneider gives in the little volume before us, of about 180 pages, not merely his conclusions, but he adds the whole material which he has collected. Instead of simply referring to an author, he quotes *in extenso* the original Greek text, and adds translations. Thus every reader is at once enabled to form his own opinion, which, we feel assured, will in most cases agree with that of our author.

In the first section Prof. Bretschneider considers the Geometry of the Ægyptians, and tries to make out how far their knowledge extended. He protests against the old opinion that they possessed only the very first notions of geometry, and that the Greeks did not obtain anything from them worthy of the name of science. He refutes equally strongly the statement of some modern writers, who maintain that the Ægyptians knew not only all that Euclid gives in his Elements, but were even acquainted with the theories of quadratic equations and of conic sections. According to him geometry originated in Ægypt, where it was cultivated for practical purposes. It was rather an *art* of mechanical drawing than a science proper. The results obtained were collected in the form of fixed rules, always ready for use, most of them probably strictly proved others perhaps resting on experience only. Those collections of rules were at an early age included in the religious canons. Any alteration, any improvement, was thus almost impossible, especially as the only cultivators of Science, the priests, would take a secondary interest only in anything not strictly connected with religion. Thus it is not to be wondered at that geometry remained for thousands of years in the same state, till the unfettered genius of the Greek nation began to cultivate it, and then the progress was a most rapid one.

It is, however, remarkable, although natural enough, that the Greeks retained to a certain extent the *form* into which Ægyptian priests had cast their propositions. For this fact there exists a testimony in a papyrus at the British Museum, formerly in the possession of the late Mr. Rhind, which contains a pretty complete treatise on Applied Mathematics, in the shape of problems which are stated in that peculiar form with which we are so well acquainted through Euclid's Elements. Dr. Birch, who has given an account of it, dates it as far back as 3400—3200 B.C. Prof. Bretschneider traces many other peculiarities in Euclid's Elements—for instance, the order of propositions—back to the same source; so that the Ægyptian priests, who lived about 6000 years ago, have, in the most direct manner, influenced the mode of teaching geometry in English schools even at the present time.

The extent of Ægyptian Geometry is estimated as follows:—the theory of angles and parallel lines; the construction of triangles, parallelograms, and trapezoids from given parts, and the determination of their areas; the elementary propositions of the circle together with the inscribed regular polygons;—this is about the sum total of Plane Geometry. In Solid Geometry their knowledge was limited to the first notions about lines perpendicular to a plane, and the theory of parallel lines and planes in space. They were acquainted with the existence of prisms, regular pyramids of four sides, of the right cone and cylinder, the sphere, and of the regular solids with the exception of the dodecahedron, which is the only one discovered by Pythagoras. Of the properties of

© 1871 Nature Publishing Group

these solids they knew little, the theory of the sphere alone appears developed to a certain degree necessary for astronomical purposes. Of proportions and similar figures they knew nothing.

The succeeding chapters relate to Geometry in Greece. We shall only mention a few of the most striking differences between Prof. Bretschneider and his predecessors. That most of the anecdotes about Pythagoras—his long captivity in Babylon, for instance,—are rejected, need scarcely be mentioned. But many readers will be surprised to hear that Plato is not considered a very eminent mathematician as he himself did almost nothing to enrich this science, and most of the theorems usually believed to be due to Plato are his pupils'. Thus the conic sections were invented by Menaichmos. Again, the *reductio ad absurdum* is considered one of the simplest methods of demonstration and used long before Euclid thought of it.

One of the most important points in the book consists in a long passage out of Eudemos' "History of Mathematics" (about 340 B.C.), which Bretschneider was fortunate enough to discover in the commentary on Aristotle by Simplikios. It contains a critique on investigations on the problem of squaring the circle. Some of the methods here employed are exceedingly interesting, as they show what means were at the disposal of the mathematician. Antiphon, a contemporary of Socrates, inscribes a regular polygon in a circle, and then proceeds in the well-known manner to double the number of sides till these at last coincide with the circumference of the circle. He then considers the circle as a regular polygon, and says that it may be converted, like any other polygon, into a square. It appears, therefore, that Antiphon was the first who introduced infinitesimals into geometry, and thus became the forerunner of Archimedes. These methods were, however, far too much in advance of his time, and Eudemos rejects them as not exact. Hippocrates, known by his quadrature of the lunulæ, makes several attempts to extend this discovery, and to obtain similar results for other lunulæ and thence for the whole circle. Some of these attempts indicate great power, although they lead to nothing tangible.

The book contains many other important results, and all those who take an interest in the history of the development of science will feel indebted to the author for its publication.

OUR BOOK SHELF

Notes on the Natural History of the Strait of Magellan and West Coast of Patagonia, made during the Voyage of H.M.S. "Nassau," in the years 1866—1869. By Robert O. Cunningham, M.D., F.Z.S., &c., Naturalist to the Expedition. (Edinburgh: Edmonston and Douglas.)

WE regret to be obliged to find fault with the work of a naturalist, but duty to our readers compels us to say that this book should never have been published. There is perhaps no part of the world which is at once so remote and inhabited by such interesting savage tribes, with the main features of whose scenery and natural productions the public is so well informed as that which forms the subject of this book. It is therefore surprising that a gentleman who has had the opportunity of studying the natural history of this region at his leisure, should have thought himself justified in printing a volume of 500 pages of his rough journal, nine-tenths of which are occupied with a bald record of the usual monotonous incidents of sea and shore excursions, and with repetitions of facts already given us by Darwin, Hooker, and a host of other less eminent writers. There are, of course, some interesting facts and some original observations in this volume, but they are so thinly scattered amid a mass of details of weather and personal incidents, with records of the gathering of every common plant and the capture of every common as well as uncommon bird or insect, as to be not worth the search after. The book too is got up with an utter disregard of the reader's convenience. The author journalises his whole voyage, and at least one third of the volume treats of other parts of the world than those indicated by the title, yet the heading throughout is "Strait of Magellan," even when Rio Janeiro, Valparaiso, or the Azores are being described. Neither is there any indication of years or months, except when a change occurs; and if we find that something was captured on the "14th," we have to go back or forward many pages to discover whether we are in May or December. The plates too are wholly without references to the letterpress; and we find a curious plant (*Philesia buxifolia*) described at page 173, and figured at page 321, with no reference from description to figure or from figure to description. The illustrations seem thrown in at random, anything the author collected being apparently deemed worthy of a plate. On no other principle can we explain the plate devoted to an indifferent figure of the cranium of so common an animal as the puma; and another to the furcula of a condor, the picking-up of which is recorded at page 113, and figured full size, *à propos* of nothing, at page 303.

It is the more to be regretted that such a book as this has been published, because there is ample room for one of a different character, and for which Dr. Cunningham must have collected or have been able to obtain ample materials. The temperate parts of South America form a well-marked district, the productions of which are exceedingly interesting and their affinities well worthy of careful study. The relations of the fauna and flora of this district to those of Tropical America, of Europe, of Australia, and of New Zealand, require a thorough and critical examination; and this could hardly fail to throw much light on the means by which organic forms have been distributed, and on the relative importance of the various zoological regions into which the globe has been divided.

The author states in his preface that he has not yet completed the examination of his materials. Why then did he rush into print before he was able to lay before the world a single generalised result of his three years' voyage? W.

Les Houillères en 1869. Par Amédée Burat, Secrétaire du Comité des Houillères Françaises. Texte et Atlas. (Paris, 1870. London: Williams and Norgate.)

THIS is an annual publication of a semi-official character, proceeding from M. Burat, the Secretary of the very useful Association of Coal-mine Proprietors in France. We are not aware that any such committee of coal owners exists in Great Britain, although other trades or professions, such as bankers, railway companies, &c., have similar committees. The Iron and Steel Institute, which has lately been holding its meeting in London, fulfils to some extent this purpose in regard to the iron trade. Wherever such associations exist we wish that they could be persuaded to publish as complete and valuable reports on the condition of their branch of trade as we have in these annual reports on the French coal trade, now available for ten or eleven years back. The present report consists of four chapters, which treat respectively of the strikes of the coal-miners, which had greatly interfered with the trade, improvements in the machinery and modes of working coal mines, the statistical conditions of the production of coal in 1860,

© 1871 Nature Publishing Group